INSTRUCTIONS AND MAINTENANCE MANUAL

SAFETY VALVES
MODELS 6400

MA-64/07

NOVEMBER 2020

VALVULAS NACIONAL, S. A. recommends you read this Instructions Manual carefully, where you can find the minimum precautions to be taken into consideration before the installation of the safety valves to ensure their correct operation.

VALVULAS NACIONAL, S. A. guarantees its safety valves against all kind of manufacture flaws for a 12-month period from their installation or maximum 18 months after their delivery, whichever occurs first. Furthermore, the company declines all responsibilities resulting from malfunction caused by an inaccurate installation, storage and / or handling by the buyer.

VALVULAS NACIONAL, S. A. considers that any safety valve with a non-original spare part installed, and / or where the certifying seal is missing as void of any guaranty.

The instructions written in bold text and in boxes must be given particular attention, as their purpose is to avoid incurring in a faulty installation, and mainly, to prevent that someone manipulating the safety valve may suffer any harm during the operation.

VALVULAS NACIONAL, S. A. reserves the right to modify all or part of the contents of this manual without previous notification.

MAIN DEFINITIONS

(UNE-EN ISO 4126-1)

Safety valve: Valve which automatically, without the assistance of any energy other than that of the fluid concernet, discharges a quantity of the fluid so as to prevent a predetermined safe pressure being exceeded, and which is designed to re-close and prevent further flow of fluid after normal pressure conditions of service have been restored.

Pressure: The pressure unit used in this standard is the bar (1 bar = 10^5 Pa). It is quoted as gauge (relative to atmospheric pressure) or absolute as appropriate.

Set pressure: The predetermined pressure at which a safety valve under operating conditions commences to open.

Maximum allowable pressure: The maximum pressure for which the equipment is designed as specified by the manufacturer.

Overpressure: A pressure increase over the set pressure, at which the safety valve attains the lift specified by the manufacturer, usually expressed as a percentage of the set pressure.

Re-seating pressure: The value of the inlet static pressure at which the disc re-establishes contact with the seat or at which the lift becomes zero.

Cold differential test pressure: The inlet static pressure at which a safety valve is set to commence to open on the test stand. This test pressure includes corrections for service conditions, e. g. back pressure and/or temperature.

Relieving pressure: The pressure used for the sizing of the safety valve which is greater than or equal to the set pressure plus the overpressure.

Built-up back pressure: The pressure existing at the outlet of a safety valve caused by flow through the valve and the discharge system.

Superimposed back pressure: The pressure existing at the outlet of a safety valve at the time when the device is required to operate.

Blowdown: The difference between the set and re-seating pressures, normally stated as a percentage on the set pressure of a safety valve.

Lift: The actual travel of the valve obturator away from the closed position.

Flow area: The minimum cross-sectional flow area (but not the curtain area) between inlet and nozzle which is used to calculate the theoretical flow to discharge.

Flow Diameter: The diameter corresponding to the flow area.

CONTENTS

1 – INTRODUCTION

The purpose of this manual is to provide all the information required for the correct installation and maintenance of model 6400 safety valves.

2 – DESCRIPTION

The model 6400 safety valves have been designed, manufactured and tested in compliance with the Pressure Equipment Directive 2014/68/UE Category IV and Directive 2014/34/UE (ATEX) Group II Category II.

The model 6400 safety valves are safety devices whose main function is to protect all kinds of pressurised containers, with gases, vapours, liquids or mixtures, from excess pressure.

For improved performance, the internal parts of the valve have been designed depending on whether the application is to work with gas of liquid. In both cases, the valve opens instantly (pop).

Model 64G.- Designed to work with gases or vapours.

Model 64L.- Designed to work with liquids or gas-liquid mixtures.

Depending on the requirements of the application, they can be supplied as conventional valves (C), bellows valves (F) or as piston valves (P).

They are constructed with an angle of 90º between the inlet and outlet connections. The flanged body has a large internal capacity to avoid backpressures when the valve discharges. Other parts are: a fixed complete nozzle easy to disassemble, a closed bonnet, an helicoidal spring-loaded, a disc holder mechanism designed accurately to obtain a good discharge coefficient with both gases and liquids. Perfect alignment of the guided components, avoiding rubbing and premature wear and tear.

All safety valves are calculated and manufactured for a specific application. If you wish to reuse an existing valve for any other application, you must contact the V.N. Technical Department for the corresponding adaptation study.

3 – TRANSPORTATION AND STORAGE

The internal components of the safety valve are precision-manufactured and fitted in such a way that they will remain perfectly aligned.

Rough handling can damage the closing surfaces or unalign the internal parts of the valve, causing leaks or malfunctions. Therefore, handle the safety valve with care.

Do not remove the adhesive protective disc that covers the inlet and outlet flanges until the valve is in its final position. This ensures the protection of the closing surfaces and prevents foreign bodies from entering into the internal chamber of the valve.

Carbon steel valves are protected externally with a phosphated anticorrosive primer coat and enamelled final coat which provides the valve a strong external protection from oxidation. The studs and nuts are protected with a dichromatized, a protection electrolytic treatment.

If the valves have to be stored for a long period of time, it is better not to remove them from their packing. It is essential for the adhesive disc that protect the inlet and outlet flanges not to be removed until their installation. It is recommended the warehouse atmosphere to be clean, dry and protected from open-air. If this is not possible, the valve must be appropriately protected to prevent from deterioration.

4 - INSTALLATION

Correct installation is essential for the safety valve to operate correctly.

Remove the adhesive protective discs from the inlet and outlet flange.

Once the valve has been fitted, it will probably need to be serviced in the short term when the valve has not been installed correctly, when the protected line is contaminated with dirt or slag, when it is given a use for which it was not designed or when the valve is not handled correctly.

Before fitting the valve, make sure that the valve is correct by checking the identification plate. Make sure the seal has not been broken (otherwise, the set pressure and tightness have to be checked again). Make sure the valve is perfectly clean and that there is no dirt inside the nozzle or in its body. If necessary, perform a blow.

The pipe, the connection flanges and the valve holders must be perfectly clean. You must be completely certain that there are no foreign bodies such as particles on the gaskets, slag, and/or dust which could be deposited on the closing surface between the disc and the nozzle.

All the bolts that fasten the valve to the container must be cross-fastened evenly to prevent deformations to the body of the valve.

When the discharge is performed through a pipe to the atmosphere, make sure that no water, dirt or condensation accumulates inside the body of the valve.

The free discharge pipes must be fastened securely to prevent the stress produced during discharge being withstood by the neck of the valve.

The valve must always be fitted in vertical position. The valve inlet pipe from the equipment or the installation must be direct and as short as possible. The return connection to the tank must be curved to avoid turbulence and to enable the discharge of the fluid by the valve.

The bellows valves have a screwed orifice on the bonnet (vent) which must be in contact with the atmosphere (Figure -1). If the fluids with which the valve works are pollutant or dangerous and in the event of a possible leak through the bellows, this orifice must be piped to a safe place and at atmospheric pressure (Figure-2).

Do not cover it up under any circumstances!!

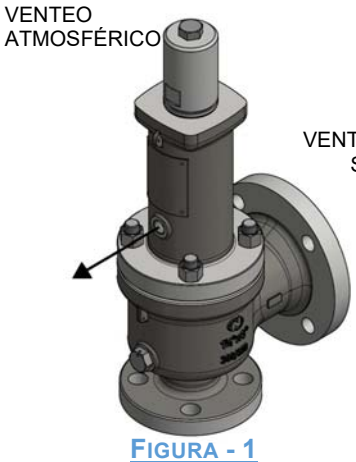


FIGURA - 1

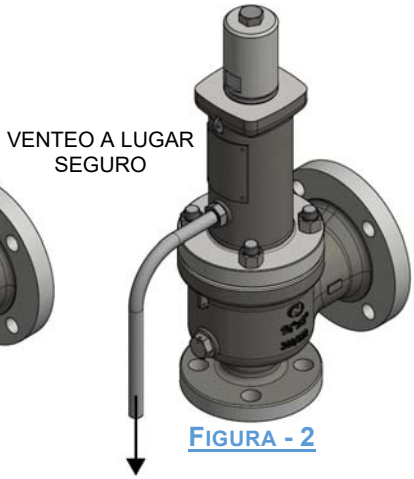


FIGURA - 2

Under no circumstances the pressure drop between the tank and the valve must be greater than 3% of the set pressure when the valve is discharging the maximum flow. If the pressure drop is greater, chattering may occur.

Check that the diameter of the inlet pipe is greater or at least equal to the diameter of the corresponding inlet connection.

The body of the valve has been dimensioned to withstand great mechanical stress; however, the installation of the discharging pipe must be studied in detail so that it does not transmit tension to the valve.

Sliding holders must be used in the installation and excessively long pipes fixed directly to the valve discharge flange must be avoided.

With valves to be used with gases, vapours or water steam, the discharge pipe must be directed upwards and be fitted with the appropriate discharge. The valves that work with liquids should be directed downwards to prevent the body of the valve from flooding.

Never point valves outlets, in service with gases or vapours, to areas where a danger for people could exist.

In gases or vapours installations, when the valve poppes, a noise level that exceeds the allowed decibel limit for persons working in the area near the valve, may be produced.

All the safety valves have a drainage orifice in the bottom part of the body. Whenever necessary, connect a tube to the drainage orifice and conduct it to a safety recipient. This prevents the accumulation of water, corrosive liquids, contaminants and other products that might deteriorate the internal parts of the valve. See Fig.-3.

FIGURA - 3

When several safety valves discharge to the same collector, the backpressure generated during the opening of one or more of them can cause indirect backpressure on the remaining valves. This can cause an increase in the set pressure by a value equal to the backpressure generated. In such cases, the valves should be fitted with bellows (balanced) so as not to be affected by the backpressure.

In the case of containers with saturated vapour, the valve must be fitted on the vapour side as far away as possible from the surface of the liquid.

In all installations, do not fit the safety valve in positions where residue can accumulate.

During the installation, bear in mind that the valve must be fitted and removed for maintenance; consequently, there must be a free access area around the valve.

The vibration of the pipes and the containers on which the valve is fitted may compromise the tightness and service life of the valve. Excessive turbulences of the fluid and pulsations of valve inlet pressure might cause chattering of the disc on the nozzle (fast opening and closing of the valve) during the discharge, reducing the tightness and the service life of the valve.

In the installations where the vibrations cannot be eliminated, we recommend to increase the difference between the operating pressure and the set pressure by a minimum of 20%.

For other installation recommendations, please consult API-RP520 “Design and Installation of Pressure – Relieving System in Refineries”.

4.1 HYDROSTATIC TEST OF INSTALLATION

When the hydrostatic test of a container or installation is required, make sure that the safety valve will not be deteriorated.

Before making the test “water upwards”, remove the cap plug (22) and fit the test-gag (36) to cancel the valve. To prevent damage to the internal parts, tighten the test-gag by hand. See Fig.-4.

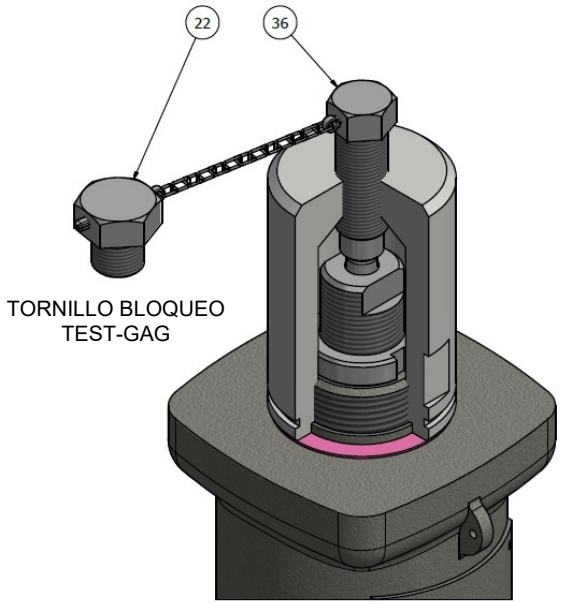


FIGURA - 4

Immediately after the hydrostatic test has concluded, replace the test gag with the plug, otherwise the safety valve will remain cancelled and the installation will not be protected from excess pressure.

When the hydrostatic test is performed "water downwards", make sure that the pressure to which the valve is to be subjected does not exceed the design limits, especially with belows valves. If possible, we recommend disassembling the valve and performing the test by installing a "blind" flange.

5 – MODIFICATION OF SET PRESSURE AND BLOWDOWN

All the valves manufactured and expedited by VALVULAS NACIONAL have been carefully assembled, tested and certified before their expedition.

We recommend that before fitting the valve in the installation you test it again to make sure that the closing elements and, therefore, the tightness, have not been damaged during transport and handling.

If for any reason it is required to modify the adjusting range of the valve, please consider Section 5.1

5.1 SET PRESSURE MODIFICATION

To modify the set pressure on an existing valve, the use of a properly selected spring is crucial.

Please consult VALVULAS NACIONAL to check and supply the spring and the new specifications plate.

The use of the spring for set pressures that are higher than those for which it was designed can lead to a lower disc holder lift (and consequently a smaller discharge capacity) and greater overpressure on the protected equipment. Similarly, the installation of a spring below its range can endanger the mechanical resistance of the spring and increase the blow-down, which means that it is more difficult for the valve to close after it has opened.

Before increasing the set pressure of an installed valve, make sure that the new pressure is within the nominal pressure range for which it has been designed. Similarly, before decreasing the set pressure, check that the discharge capacity with the new pressure is enough to protect the container with which it operates.

Once you are absolutely certain that the selected spring is correct for the new application, complete the change by following the instructions given in Section 6.

5.2 BLOW-DOWN ADJUSTMENT

The reduction of the re-seating pressure with regard to the set pressure when the valve closes after popping can be adjusted by the adjusting ring (7), mounted on the nozzle (4). Check drawings on pages 10; 11 and 12.

Valves from VALVULAS NACIONAL are designed with a standard range of the blowdown value between 10% and 15%. To complete the adjustment, proceed as follows:

Unscrew the lock screw (14) which contains the lock stud (22) that fixes the adjusting ring (7).

Through the orifice of lock screw and using a screwdriver, turn the adjusting ring upwards (anticlockwise) until it comes into contact with the disc holder (8), then make it come down by turning it clockwise as many notches as indicated in table 1.

Table -1

ORIFICE	VALVE MODEL	
	64G (C,F,P) GAS	64L (C,F,P) LIQUID
D, E	2	2
F	3	2
G	3	3
H	4	3
J	5	4
K	7	5
L	9	7
M	12	9
N	14	10
P	17	12
Q	15	11
R	18	14
T	23	16
Notch correction from contacting with disc holder		

Once the adjusting ring has been adjusted, the lock screw has to be re-assembled, checking that the stud remains placed inside the notch of the adjusting ring, and fixing the adjusting ring to keep it from spinning, but free for its auto-alignment.

To increase the blow-down (the valve closes at a very low inlet pressure), the adjusting ring must be raised by turning the notches anticlockwise (from left to right).

To decrease the blow-down (the valve closes at a very high inlet pressure), the adjusting ring must be lowered by turning the notches clockwise (from right to left).

6 - MANTEINANCE

If the valve has been operating on an installation with fluids classified as dangerous or contaminant, it must be decontaminated before it is touched.

It is extremely important to follow the disassembly instructions in order as follows, otherwise it may be dangerous for the worker who manipulates the valve, owing to the spring stress.

6.1 DISASSEMBLY AND ASSEMBLY OF THE 64GC AND 64LC MODEL VALVES

To assembly and disassembly, please consult the valve section drawings on Page 10.

6.1.1 DISASSEMBLY

Unscrew the nuts (25), remove the cap (3); (for screwed caps, disassembly unscrewing it by turning it anticlockwise).

To disassembly the lever cap, see Section 6.3 and Figure-7.

Before loosening adjusting screw (11), take note of the distance from the top of it to the end of the stem (9). You will then be able to return the adjusting screw to the same position during assembly.

Loosen the adjusting screw nut (13) and set free the spring stress (10) unscrewing the adjusting screw (11).

Disassembly the bonnet (2) unscrewing body nuts (24).

Do not perform this operation under any circumstances unless you are completely sure that spring stress has been completely set free.

Disassembly the spring (10) and the spring buttons (15).

Pull on the stem (9), to remove the set composed of the following parts: guide (6), push rod (12), disc holder (8) and disc (5). To disassemble this set, unscrew the disc holder from the push rod, setting free the stem-push rod, the guide and the set composed of disc-disc holder. To disassemble the disc from the disc holder, screw in the drill it has for this purpose a screw or tool which allows to extract it from the disc holder. See Fig.-5.

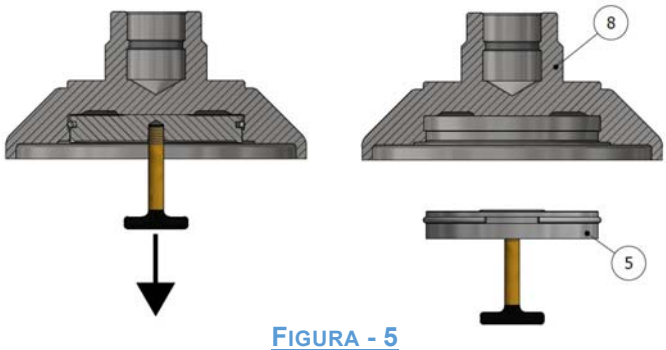


FIGURA - 5

Unscrew the adjusting ring (7), once the lock screw (14) has been removed, which is fixed by the lock stud (20).

To disassembly the nozzle (4) from the body (1) of the valve, fix the body and, use the drill of the outside diameter of the nozzle and with a suitable tool, turn it anticlockwise.

6.1.2 ASSEMBLY

The procedure to assemble the valve will be exactly the opposite of the one used to disassemble it.

All components must be cleaned, checked and polished insisting on sliding and frictional surfaces.

When assembling, it is extremely important to grease all screwed unions, sliding guide areas and the different kneecap points that prepare the internal parts of the valve for self-centring. See Fig-6.

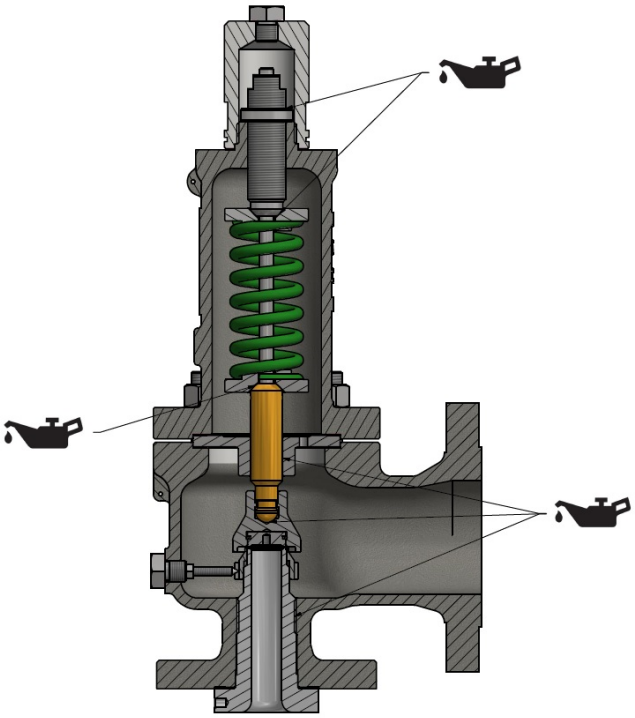


FIGURA - 6

For a good performance of the valve it's extremely important to keep the internal components aligned.

Replace all the gaskets. The reuse of them can lead to malfunctions, such as leaks, connected chambers and variations in the opening lift.

The blow-down adjusting ring must be fitted taking into account its position before it was removed or consulting Table 1 (turn clockwise the same number of notches, from the contact position of the ring with the disc holder).

To assemble the disc inside the disc holder, put the disc holder with the bell positioned upwards; place the disc with the elastic ring in position and press it in.

As the nozzle and the disc closing surfaces are lapped with a “mirror like” finish, it is important to fit them very carefully so that they do not receive any knocks, since no matter how slight the knock, it could make marks and, consequently, lead to fluid leaks, making it necessary for it to be removed and relapped.

Press adjusting screw until the position noted during the disassembly. This will prevent unnecessary pops and, therefore, this will reduce possible marks on the closing surfaces of the valve.

6.2 DISASSEMBLY AND ASSEMBLY OF THE 64GF, 64LF, 64GP AND 64LP VALVE MODELS

To assembly and disassembly these models of valve, consult the valve section drawings on Pages 11 and 12.

During the assembly and disassembly of these valve models, particular care must be taken due to the fact that they include a bellows (33), which is an extremely fragile component. If handled roughly, it may go out of shape and be useless for refitting.

6.2.1 DISASSEMBLY

The valves 64GF; 64LF; 64GP y 64LP are disassemblied in the same way as the 64GC y 64LC, except for the disassembly of the bellows, which is carried out as follows:

Once have extracted stem (9), push rod (12), guide (6), disc holder (8), disc (5) and bellows (33) from the valve body, unscrew the push rod from the disc holder to free the guide. During this operation, take special care since, owing to the weight of the guide, if it is not handled correctly, it may damage the bellows. Use the drill of the threaded part of bellows and with a suitable tool, unscrew the bellows from the disc holder (bellows of orifices up to “J” are welded to disc holder forming only one single component). To disassemble disc from disc holder, see Fig.-5.

In valve models 64GP y 64LP, depending on the size, the push rod (12) and piston (46) can be one single component or two. To disassemble the piston, remove the elastic ring (47).

6.2.2 ASSEMBLY

For the assembly process, proceed in reverse order with regard to the disassembly process, bearing in mind the recommendations given in Section 6.1.2 and following:

In bellows-disc holders up to orifice “J”, which are of one single component, take special care not to damage the bellows when assembling the disc in the disc holder. In the others, first assemble the disc in the disc holder first and then screw the bellows to the disc holder.

Make sure that the screwed orifice of the bonnet (vent) is uncovered. This is essential for the valve to operate correctly. See Fig.-1.

6.3 DISASSEMBLY AND ASSEMBLY OF LEVER CAP.

6.3.1 DISASSEMBLY

To disassemble the lever cap, position the lever (41) at its lowest position, unscrew the nuts (25) and remove the unit. See Fig.-7.

Before unscrewing stop-nuts (38), take note of the distance “h”, between the upper nut and the top of the stem (40). Therefore, when you reassemble the unit, you will be sure that the lever is in the correct position.

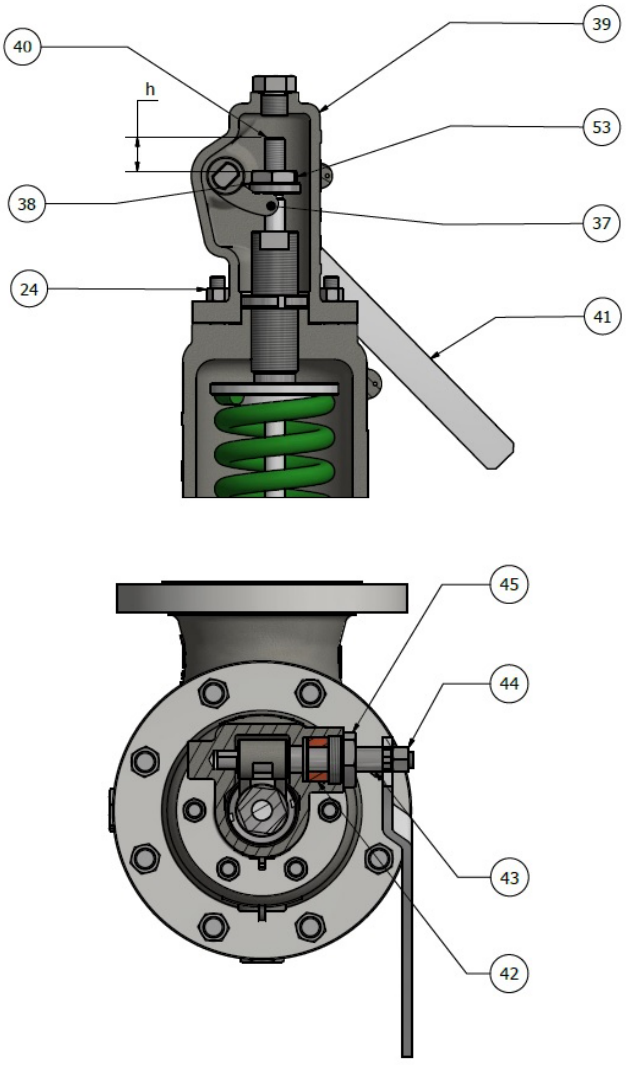


FIGURA - 7

Unscrew the nut (44), to release the lever (41) from the shaft (43). Disassemble the packing gland (45) and

remove the packing (42) from the casing. Pull on the shaft, taking into account that the cam (37) will come loose inside the cap.

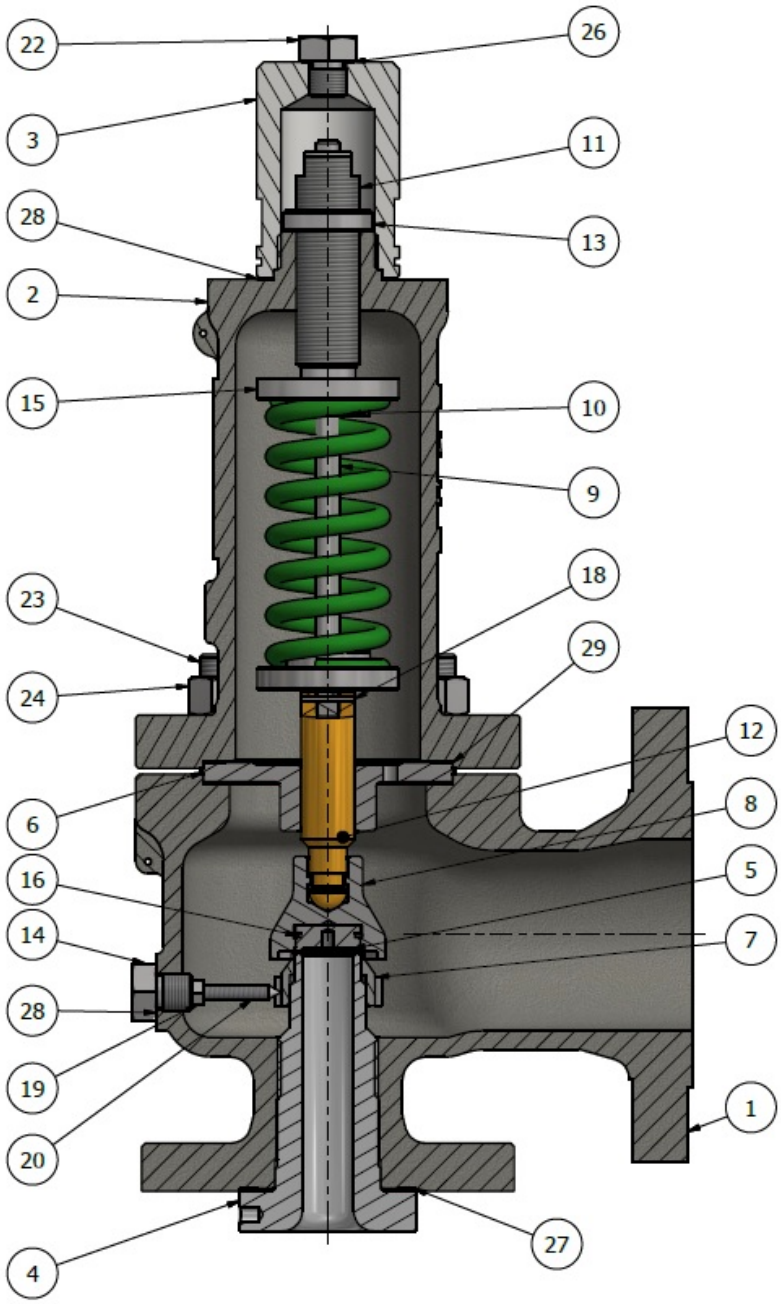
6.3.2 ASSEMBLY

Once the parts have been checked and cleaned, begin the assembly inserting the cam (37) inside the cap (39), fit the shaft (43) in position by inserting the cam. Lightly grease the emplacement of the packing slightly to enable the sliding movement and insert sufficient packing rings (42) so that once they are packed tight, the packing gland (45) does not come into contact with the cap and the shaft becomes blocked laterally. Once the lever has been fitted (41), a certain amount of resistance should be noticed when it is operated due to the rubbing on the packing.

To assemble it on the valve, proceed in reverse order with regard to the disassembly.

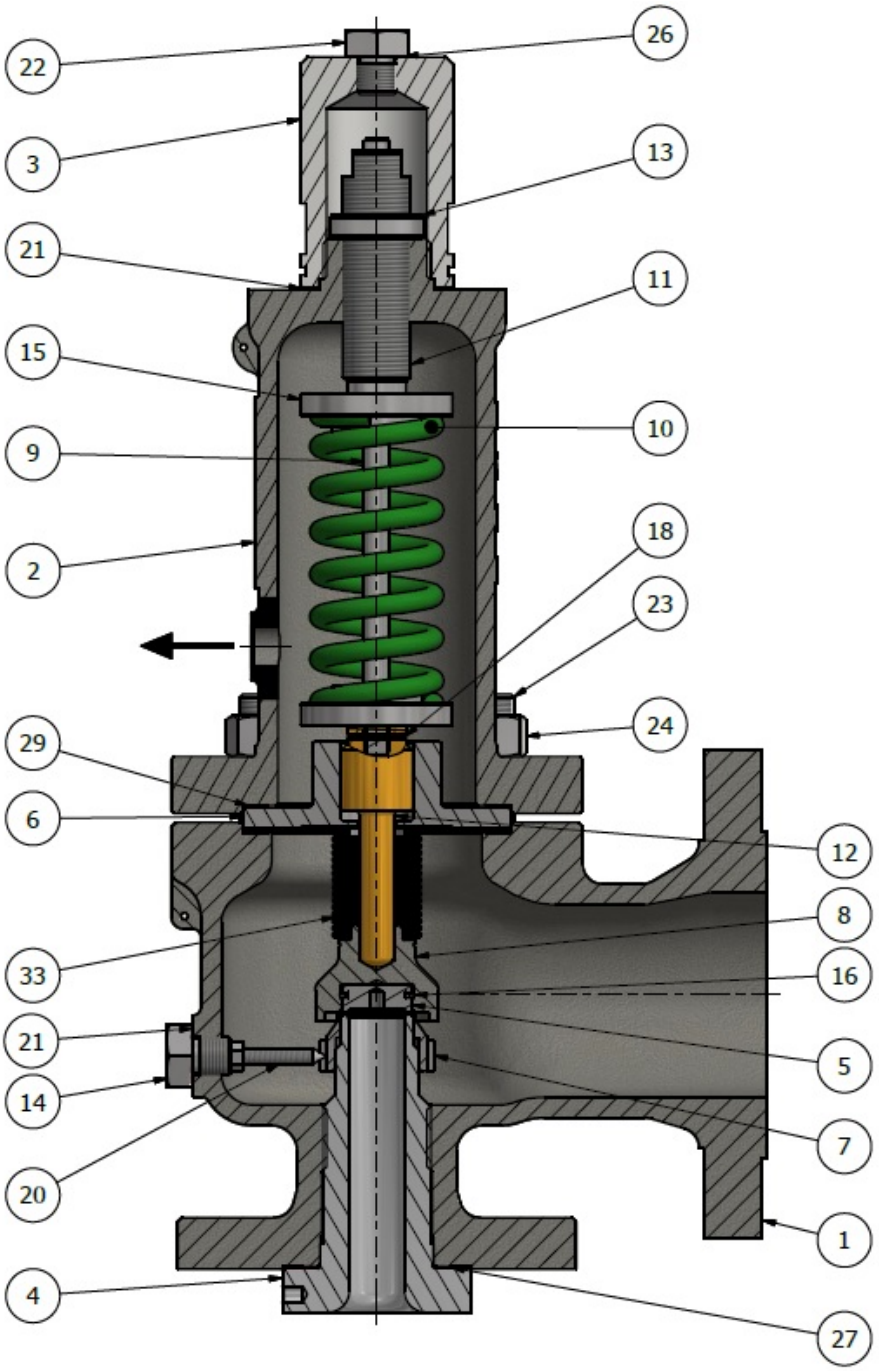
Under no circumstances must you reuse the packing rings because, once pressed, it is very difficult to get good tightness.

CONVENTIONAL SAFETY VALVES MODELS **64GC** AND **64LC**



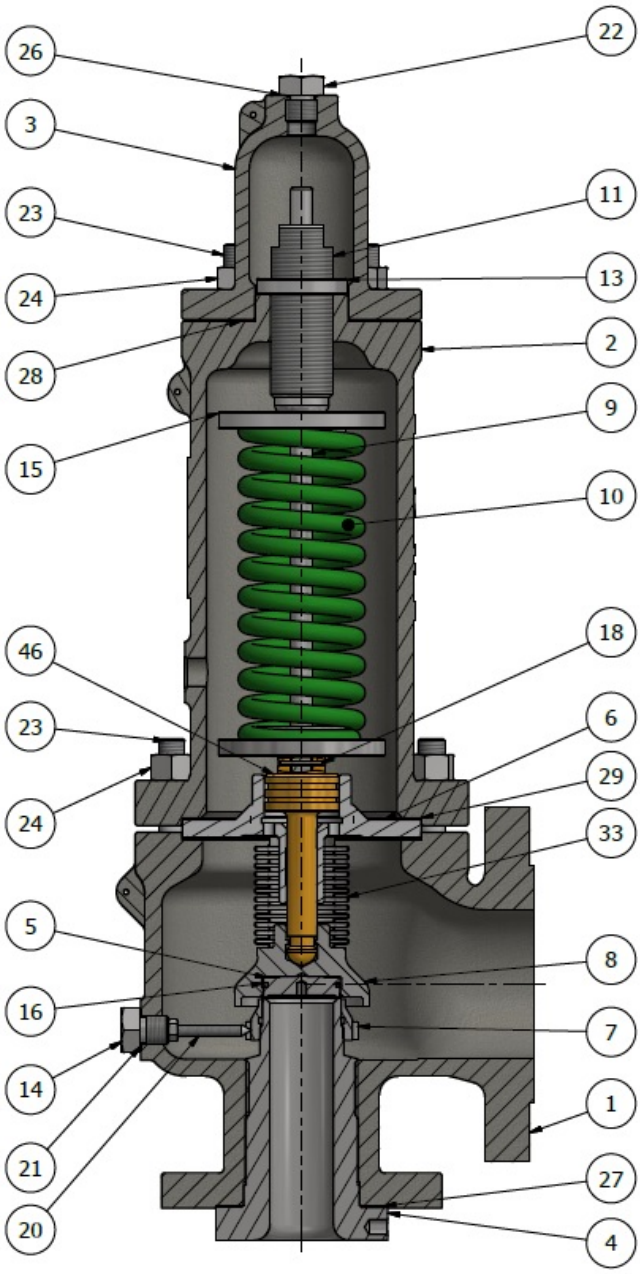
Nº	PART NAME	Nº	PART NAME
1	BODY	16	ELASTIC RING
2	BONNET	17	PLUG
3	CAP	18	ELASTIC PIN
4	NOZZLE	20	LOCK STUD
5	DISC	21	GASKET
6	GUIDE	22	PLUG
7	ADJUSTING RING	23	STUDS
8	DISC HOLDER	24	NUT
9	STEM	25	SCREW
10	SPRING	26	GASKET
11	ADJUSTING SCREW	27	GASKET
12	PUSH ROD	28	GASKET
13	NUT	29	GASKET
14	LOCK SCREW		
15	SPRING BUTTON		

BALANCED SAFETY VALVES (BELLOWS) MODELS **64GF** AND **64LF**



Nº	PART NAME	Nº	PART NAME
1	BODY	16	ELASTIC RING
2	BONNET	17	PLUG
3	CAP	18	ELASTIC PIN
4	NOZZLE	20	LOCK STUD
5	DISC	21	GASKET
6	GUIDE	22	PLUG
7	ADJUSTING RING	23	STUDS
8	DISC HOLDER	24	NUT
9	STEM	25	SCREW
10	SPRING	26	GASKET
11	ADJUSTING SCREW	27	GASKET
12	PUSH ROD	28	GASKET
13	NUT	29	GASKET
14	LOCK SCREW	33	BELLOWS
15	SPRING BUTTON	34	GASKET

BELLOWS-PISTON SAFETY VALVES MODELS **64GP** AND **64LP**



Nº	PART NAME	Nº	PART NAME
1	BODY	17	PLUG
2	BONNET	18	ELASTIC PIN
3	CAP	20	LOCK STUD
4	NOZZLE	21	GASKET
5	DISC	22	PLUG
6	GUIDE	23	STUDS
7	ADJUSTING RING	24	NUT
8	DISC HOLDER	25	SCREW
9	STEM	26	GASKET
10	SPRING	27	GASKET
11	ADJUSTING SCREW	28	GASKET
12	PUSH ROD	29	GASKET
13	NUT	33	BELLOWS
14	LOCK SCREW	34	GASKET
15	SPRING BUTTON	46	PISTON
16	ELASTIC RING	47	LOCK WASHER

6.4 RECONDITIONING OF CLOSING SURFACES.

The perfect tightness of the safety valve depends largely on the condition of the closing surfaces, the contact surfaces between the nozzle (4) and the disk (5).

If the safety valve has excessive leaks and you do not have the means or experienced personnel, we recommend that you send the valve to our installations, where it will be checked thoroughly and the corresponding repair certificate will be issued.

6.4.1 LAPPING OF CLOSING SURFACES

Owing to the fact that a perfect lapping of the nozzle and the disk surfaces is essential for the valve in order to avoid leaks, we recommend this operation to be carried out with the appropriate means and by experienced workers.

When the closing surface has been slightly damaged, a lapping operation will suffice to return it to optimum conditions. If the closing surface is weathered or too marked by dirt, it must be resurfaced as finely as possible in a lathe before it is lapped. (See Section 6.4.2 and 6.4.3)

To perform manual lapping, you must have a special lapping plate made of alloy grade cast-iron or a flat, polished surface (for example, a glass disk), together with the different lapping products depending on the finish required. See Table-2.

Table - 2

GRAIN	DIMENSION (μ)	FINISH TYPE	PRODUCT
400	15 ÷ 21	MEDIUM	IN SUSPENSION SILICIUM CARBIDE
800	7,5 ÷ 10,5	THIN	
1200	4 ÷ 6	MIRROR-LIKE POLISHED	IN SUSPENSION DIAMOND POWDER

In the standard process, after reconditioning the closing surfaces, the lapping process is carried out with a product for medium finish. When perfect flatness has been obtained, lap with a fine-finish product on a different surface. If operating conditions of the valve requires more tightness, the final finish must be obtained with a suspension diamond powder solution, leaving the closing surface with a polished mirror-like finish.

The lapping process is carried out as follows:

Apply a fine layer of paste with the selected grain to the lapping plate surface for the type of finish you wish to obtain. Do not use the same surface for different types of finishes and clean it well after each lapping process.

Place the piece perfectly flat on the lapping surface and, pressing lightly and evenly, move it in the shape of an eight until the desired finish is obtained. When a lapping ring is used, the movement should be oscillating.

It is recommendable to remove the nozzle from the body of the valve for correct lapping. If this is not possible or if the surface is only slightly damaged, use the lapping ring. Remember that excess paste on the lapping ring can round off the edges of the nozzle lip.

The most important basic conditions for obtaining a good final result in the lapping process are:

A) Flat surface for supportting the lapping plate.
B) Flat, cleaned and polished lapping surface.
C) Clean the lapping plate, the part that is to be lapped and the lapping paste.
D) Choice of the type of grain of the lapping paste for the required finish.
E) Even and smooth lapping movement (without vibrations or sudden movements).
F) A worker specialised in lapping operation.

6.4.2 NOZZLE MACHINING

When the closing surface of the nozzle has marks with a depth that cannot be removed with lapping, the surface must be machined in a lathe, removing as little material as possible.

To machine the closing surface, fasten the nozzle by its flange, on a plate with three self-centring claws. Using a comparator, make sure that the concentricity between the internal surface of the nozzle and the external surface of the flange is on a limit of 0,05 mm.

Machine the closing surface until the damaged area is fully recovered, checking that as thinner is the finish as lapping will be easier. Recompose nozzle lip until the original width is obtained in the closing area, observing the length between the closing surface and the face of the flange that is in contact with the body of the valve.

Lap the closing area until a “mirror-like” finish is obtained. See Section 6.4.1.

6.4.3 DISC MACHINING

To machine the closing area, fix the disk on the lathe plate, avoiding excessive pressure so as not to produce deformations. Centre the disk using a comparator, making sure that the outside diameter and the closing surface are aligned within a tolerance of 0,05 mm.

Machine the closing surface until the damaged area has been fully recovered. Recompose the lip until the original width is obtained in the closing area.

Lap the closing area until a “mirror-like” finish is obtained. See Section 6.4.1.

7 – SET PRESSURE ADJUSTMENT AT THE TEST BENCH

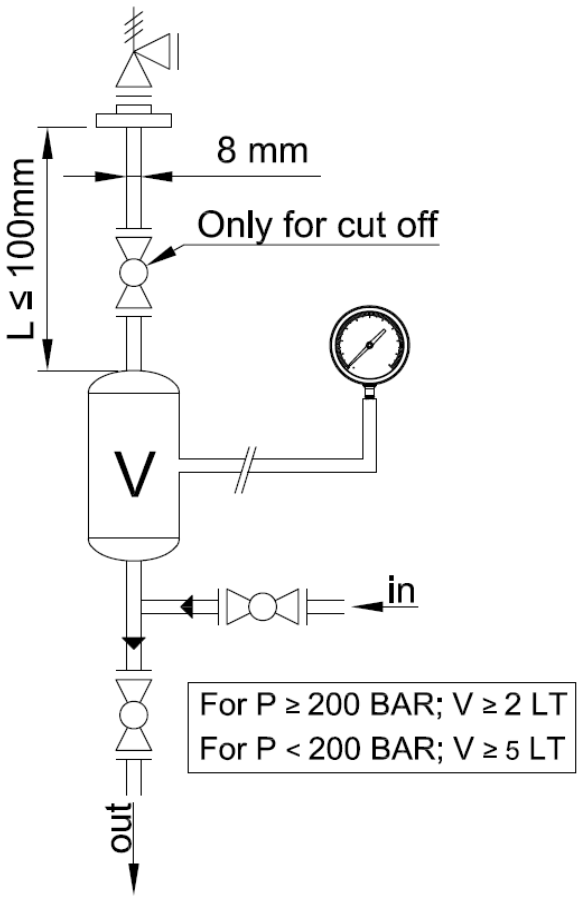
All tests and adjustments must be made by workers who have been appropriately technical trained in the operation of safety valves, as well as in the risks involved in the tests.
Eyes and ears must be protected when the valve is under pressure.
Also, when valve is under pressure, NEVER stand in front of its outlet flange.

7.1 GASES AND VAPOURS

If a valve test bench is not available, the pressure adjusting test may be performed using a pressurized reservoir (bottle) with air or nitrogen, if possible, with a good shock-absorbing “mattress” to avoid damaging the closing areas of the valve when the popping is done.

The connection between the valve and the container must be preferably direct through a cut-off valve. The connection pipe must have a minimum inside diameter of 8 mm.

INFORMATIVE SKETCH



It’s necessary to blow the connections and pipes of the test bench before placing the valve to eliminate any dirt that may have deposited there, which would damage the closing areas.

The test can be performed in two different ways:

A) Increase the valve inlet pressure until there is a continuous leak of fluid which can be identified by a whistler or an unexpected noise.

B) Increasing the valve inlet pressure until it pops. To get this, position the adjusting ring in contact with the bell of the disc holder and then lower it one or two notches. To perform this operation, proceed as indicated in Section 7.4.

If the test is carried out correctly, the results of both methods are practically identical.

Test (B) requires a larger container to prevent damage to the closing surfaces and greater care must be taken when fastening the valve.

7.2 LIQUIDS

This test is performed with clean water at ambient temperature.

The test circuit must be purged and there must be no accumulation of gas inside the test system. The use a vacuum pump to depressurize the circuit before filling with the test liquid is recommended.

An accumulation container is not normally necessary but an air/water expansion tank is essential if an alternative pump is used.

The set pressure will be identified when a continuous jet of water flows vertically from the valve discharge flange.

7.3 TEMPERATURE AND BACKPRESSURE CORRECTIONS

When the valve that is to be corrected on the test bench at ambient temperature and atmospheric pressure is to operate with temperatures of over 100 ºC and/or a backpressure other than atmospheric, a correction by temperature and backpressure must be made in the adjustment of the set pressure in conventional valves.

For balanced valves (with bellows), only the correction by temperature correction must be carried out since the backpressure is compensated by the bellows.

The correction factor indicated in Table-3 must be applied to the set pressure of the valves that are to work with fluids at temperatures of over 100 ºC.

Table-3

OPERATING TEMPERATURE	INCREASE OF THE SET PRESSURE
Up to 100º C	0 %
FROM 101º C TO 250º C	2 %
FROM 251º C TO 500º C	3 %
Over 500º C	5 %

The above correction factor must be applied even through the valve set pressure has been corrected to compensate the effect of backpressure.

Therefore, the pressure at which the valve must be tested in the bench, known as the Cold Differential Test Pressure, is the inlet pressure at which the valve will open on the test bench at ambient temperature and atmospheric pressure.

To perform the exact calculation of the cold differential test pressure, the pressure at which the valve in question must open has to be taken into account, together with the increase by temperatures over 100 ºC and the backpressure that is different from atmospheric pressure.

Examples of the calculation of the cold differential test pressure with regard to backpressure and temperature:

A) DATA: Conventional valve (without bellows), set pressure 20 bar, operating temperature 260ºC and constant backpressure 1 bar, vapour service.

The cold differential test pressure adjustment:

20 bar – 1 bar = 19 bar

According to the table for temperature correction, a correction factor of 3% must be applied (because temperature is between 251ºC and 500ºC):

3 % of 19 bar = 0,57 bar (~ 0,6 bar)

Therefore, the cold differential test pressure to which the valve must be adjusted in the bench will be:

19 bar + 0,6 bar = **19,6 bar**

B) DATA: Balanced valve (with bellows), set pressure 50 bar, operating temperature 180ºC and constant backpressure 1,5 bar, vapour service.

The cold differential test pressure adjustment:

As it is a balanced valve (with bellows), the backpressure does not affect to the set pressure, therefore, the backpressure is not substracted.

According to the table for temperature correction, a corrector factor of 2% must be applied (because temperature is between 101ºC and 250ºC):

2% of 50 bar = 1 bar
Therefore, the cold differential test pressure to which the valve must be adjusted in the bench will be:

50 bar + 1 bar = 51 **bar**

The procedure is always the same and applicable in all valve models.

7.4 ADJUSTING RING POSITION

For the pop of the valve in test benches where the flow is low, the control ring must be adjusted as follows. Once the tests have been completed, position the ring as indicated in Table 1.

Do not carry out this operation when the valve is under pressure, since it could lead to accidental popping and cause injury to the worker who is working on the valve.

Disassemble lock screw (14), turn the adjusting ring (7) anticlockwise rotation until the bell comes into contact with the disk holder (8). Then lower clockwise 1 or 2 notches to prevent contact. This operation can be carried out using a screwdriver through the valve outlet flange or through the locking screw hole.

Once the ring is in its position, fit the locking screw paying attention that lock stud (20) is placed between the adjusting ring notches. Once the lock screw is tightened, make sure the ring is fixed so that it does not turn but is free for self-alignment.

It may be necessary to readjust the blowdown once the valve has been fitted since, depending on the product, temperature, pressure and type of installation, it may have been altered.

7.5 SET PRESSURE ADJUSTMENT

If valve opens at lower or higher pressure than set pressure, the spring needs to be adjusted as shown below:

A) Disassemble the cap (3) or (39) if the valve has a lever.

B) Loosening the adjusting screw nut (13), the adjusting screw will be freed (11). Turn it clockwise to increase the set pressure and anticlockwise to reduce it.

C) Once the set pressure has been reached, tighten the nut and assemble the cap.

The tolerance ranges for adjusting the set pressure are from ± 0,15 bar for pressures equal to or less than 4,8 bar and ± 3% for pressures over 4,8 bar.

Do not adjust the set pressure under any circumstances when the valve is under pressure, since the closing surfaces of the nozzle and the disk may be damaged if sliding occurs.

8 – TIGHTNESS TEST

Tightness tests of the valves that work with gases and vapours or liquids must be performed after the set pressure has been adjusted and using the same fluid.

With valves with a set pressure of over 3,5 bar, the test pressure shall be set to 90% of the set pressure. With valves without set pressure equal or less than 3,5 bar, the test pressure shall be 0,35 bar below the set pressure.

With this test, particular care must be taken since there is a risk of unexpected popping because of the fact that work is being carried out under conditions that are very near to the set pressure and there may be a hazard for the worker who is working with the valve.

8.1 TIGHTNESS TEST WITH AIR

Figure 9 shows the methods to be used for this test on files that are to work with gases or vapours.

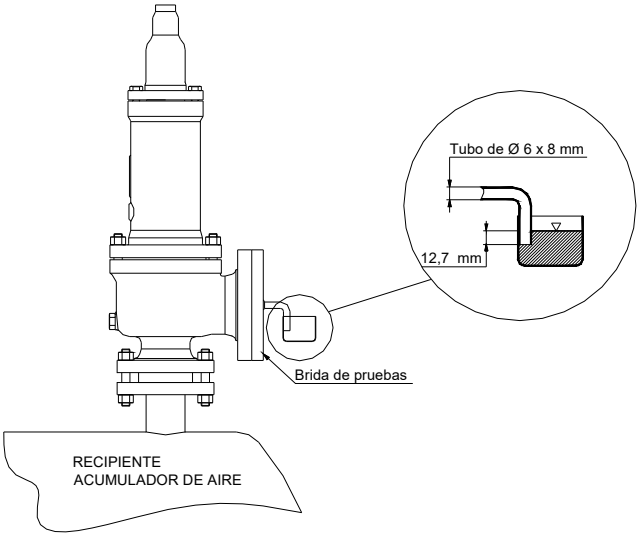


FIGURA - 8

The valve outlet must be covered with a flange whose only outlet hole is a pipe with an interior diameter of 6 mm and a wall of 1 mm, curved at 90º whose end is submerged 12,7 mm in a container with water.

With tightness test pressure adjusted as indicated in Section 8 and after maintaining it for 1 minute with a size of DN-50 (2") or less; 2 minutes for valves with a size of DN-80 and DN-100 (3" and 4") and 5 minutes for valves with a size of DN-150 (6") or higher; count the bubbles that appear during a period of 1 minute.

The test is passed as long as the values indicated in table 4 are not exceded, as recommended by the API-RP 527 Standard.

VALVE SET PRESSURE Barg. AT 15,6º C	ADMISSIBLE BUBBLE LEAKS PER MINUTE	
	ORIFICES "C" TO "F"	ORIFICES "G" TO "T"
	DIAMETER ≤18mm	DIAMETER>18 mm
FROM 1 TO 69	40	20
TO 103	60	30
TO 130	80	40
TO 172	100	50
TO 207	100	60
TO 276	100	80
TO 385	100	100
TO 414	100	100

Table – 4

8.2 TIGHTNESS TEST WITH WATER

Before adjusting tightness test pressure, fill the interior of the body with water. When it has stabilized and water has stopped running through the valve outlet flange, adjust the tightness test pressure as indicated in Section 8.

When the test pressure has been adjusted, collect the drops that fall from the outlet nozzle during the period of one minute in a container. The amount collected shall not exceed 10 cm³/h for every 25 mm nominal diameter of the valve (API-RP 527).

8.3 EXCESSIVE LEAK

If the tightness test has been performed correctly and it gives a result of excessive leakage, remove the valve to check that there is no dirt or foreign bodies between the nozzle and the disk.

If the leakage is due to dirt from the contamination of the test fluid, simply clean the closing surface with cellulose paper or any other non-abrasive medium soaked in solvent. However, if the leakage is due to marks on the closing surface and in accordance with the depth of the marks, relap or recover the surfaces as indicated in Section 6.4.

9 – TEST PRESSURE GAUGES

The pressure must be measured using pressure gauges that have been regularly checked and calibrated, and whose calibration is certified accordingly, as ANSI B 40.1 Grade A Standard indicates.

The pressure gauge must be selected in accordance with the test pressure, which must be between 25% and 75% of the scale bottom, where an error no greater than 1% of the measurement field is acceptable.

10 - ATEX MARKING

The safety valves supplied for installation in potentially explosive atmospheres are compliant with Directive 2014/34/UE (ATEX). They are classified within Group II, Category 2, and marked with a specifications plate that reads as follows:

TX	TEMPERATURES RANGE T (ºC)
T1	300º<T≤450º
T2	200º<T≤300º
T3	135º<T≤200º
T4	100º<T≤135º
T5	85º<T≤100º
T6	T≤85º

10.1 SAFETY RECOMMENDATIONS

To avoid the risk of ignition, bear in mind the following points:

a) Prevent dust from accumulating on the valve casing.

b) It is absolutely important to keep the protective painting on the casing in good condition, owing to the fact that, if there is any friction or shock, the oxide would act as a high risk of ignition.

c) It is essential to make sure that the valve is not insulated from the earth connection of the installation, since the different layers of paint resulting from its maintenance create a plastic insulation on the valve that favours the accumulation of static electricity which, if not eliminated correctly, can produce radiant discharges that could lead to ignition.

d) When the valve has to be fitted to or removed from the installation, use tools that do not produce sparks from friction.

FAILURE	POSSIBLE CAUSE	SOLUTION
Excessive leak	Dirt between nozzle and disc.	Perform one or two pops and check. If there is a leak again, internal components should be disassembled and cleaned.
	Marked or scratched closing surfaces.	Disassemble valve and lap nozzle and disc.
	Use the valve with a fluid different to the one it was designed for.	Lap nozzle and disc with the thinnest polish finish. (Typical behaviour of valves designed to be used with liquids and really used with gases).
	Valve isn't installed in upright position.	Modify installation. Valves should be always installed in upright position.
	Set pressure is too close to operating pressure (When operating pressure is more than 90 % of set pressure, leaks could be produced).	Increase set pressure to get a 10 % minimum differential. If that's not possible, you should modify closing surface (to provide "stellite", lap with an extremely thin grade, etc.)
Discharge of the valve at a different pressure it's been adjusted	Built-up backpressure.	In conventional valves, you should check that the release manifold has the same size or greater than the outlet connection of the safety valve and / or there's no obstruction. Ideally, install balanced valves (with bellows).
	Backpressure different to early specified.	Valve should be adjusted considering the correct backpressure (conventional valves).
	Loose adjusting screw nut.	Tighten nut once valve has been adjusted again.
	Misalignment of the internal components of the valve.	Perform 2 or 3 pops so that valve could self-align.
Chattering (fast and cyclic opening and closing of the valve.)	Excessive turbulences at the valve inlet.	Modify the valve installation.
	Adjusting ring (blow-down) incorrectly positioned.	Check that the adjusting ring is correctly positioned. If not, adjust it according to Section 5.2.
	Oversized valve.	Recalculate and install correct valve.
	Excessive pressure drop at the valve inlet.	Increase blow-down positioning the adjusting ring as nearest as you can to disc holder bell.
	Accumulation is too small.	Increase the distance between the adjusting ring and the disc holder.

NOTES

For valves with BW connections applied as indicated in the document except that where indicated inlet or outlet flange should be understood as BW inlet or outlet connection respectively.

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